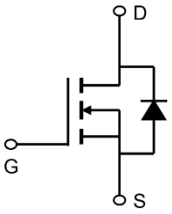
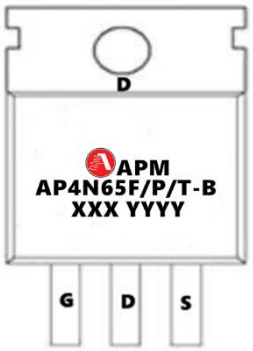
# AP4N65F/P/T-B

## 650V N-Channel Enhancement Mode MOSFET

### Description

The AP4N65F/P/T-B is silicon N-channel Enhanced VDMOSFETs, is obtained by the self-aligned planar Technology which reduce the conduction loss, improve switching performance and enhance the avalanche energy. The transistor can be used in various power switching circuit for system miniaturization and higher efficiency.




### General Features

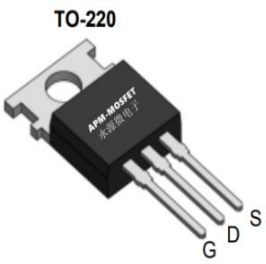
$V_{DS}$ = 650V $I_D$ =4A

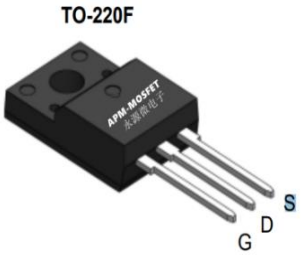
$R_{DS(ON)}$ < 2.5Ω @ $V_{GS}$=10V **（Type：2.2Ω）**

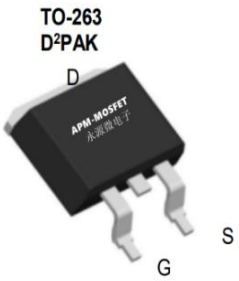
### Application

Uninterruptible Power Supply(UPS)

Power Factor Correction (PFC)




### Package Marking and Ordering Information

| Product ID | Pack | Marking | Qty(PCS) |
|---|---|---|---|
| AP4N65F-B | TO-220F-3L | AP4N65F-B XXX YYYY | 1000 |
| AP4N65P-B | TO-220-3L | AP4N65F-B XXX YYYY | 1000 |
| AP4N65T-B | TO-263-3L | AP4N65T-B XXX YYYY | 800 |

### Absolute Maximum Ratings ($T_C$=25℃unless otherwise noted)

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| VDSS | Drain-Source Voltage ($V_{GS}$ = 0V) | 650 | V |
| $I_D$@$T_C$=25℃ | Continuous Drain Current, $V_{GS}$ @ 10V | 4.0 | A |
| $I_D$@$T_C$=100℃ | Continuous Drain Current, $V_{GS}$ @ 10V | 3.0 | A |
| IDM | Pulsed Drain Current (note1) | 16 | A |
| VGS | Gate-Source Voltage | ±30 | V |
| EAS | Single Pulse Avalanche Energy | 125 | mJ |
| IAS | Avalanche Current | 5 | A |
| $P_D$ | Power Dissipation ($T_C$ = 25ºC) | 27 | W |
| TJ, Tstg | Operating Junction and Storage Temperature Range | -55~+150 | ºC |
| RthJC | Thermal Resistance, Junction-to-Case | 4.7 | ºC/W |
| RthJA | Thermal Resistance, Junction-to-Ambient | 62.5 | ºC/W |

## Electrical Characteristics ($T_J$=25℃, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| V(BR)DSS | Drain-Source Breakdown Voltage | ID = 250μA, VGS = 0V | 650 | - | - | V |
| IDSS | Zero Gate Voltage Drain Current | VDS = 650V, VGS = 0V | - | - | 1.0 | μA |
| IGSS | Gate-Body Leakage Current | VDS = 0V, VGS = ±30V | - | - | ±100 | nA |
| VGS(th) | Gate Threshold Voltage | VDS = VGS, ID = 250μA | 2.0 | 3.0 | 4.0 | V |
| RDS(ON) | Static Drain-Source ON-Resistance(4) | VGS = 10V, ID = 2A | - | 2.2 | 2.5 | Ω |
| Ciss | Input Capacitance | VGS = 0V, VDS = 25V, f = 1MHz | - | 587 | - | pF |
| Coss | Output Capacitance | | - | 59 | - | pF |
| Crss | Reverse Transfer Capacitance | | - | 10 | - | pF |
| Qg | Total Gate Charge | VGS = 0 to 10V VDS = 520V, ID = 4A | - | 15 | - | nC |
| Qgs | Gate Source Charge | | - | 3.5 | - | nC |
| Qgd | Gate Drain("Miller") Charge | | - | 6 | - | nC |
| td(on) | Turn-On DelayTime | VGS = 10V, VDD = 320V ID= 4A, RGEN = 24Ω | - | 13 | - | ns |
| tr | Turn-On Rise Time | | - | 22 | - | ns |
| td(off) | Turn-Off DelayTime | | - | 43 | - | ns |
| tf | Turn-Off Fall Time | | - | 27 | - | ns |
| IS | Maximum Continuous Drain to Source Diode Forward Current | | - | - | 4 | A |
| ISM | Maximum Pulsed Drain to Source Diode Forward Current | | - | - | 16 | A |
| VSD | Drain to Source Diode Forward Voltage | VGS = 0V, IS = 4A | - | - | 1.2 | V |
| trr | Body Diode Reverse Recovery Time | IF = 4A, di/dt = 100A/us | - | 280 | - | ns |
| Qrr | Body Diode Reverse Recovery Charge | | - | 2 | - | μC |

**Note :**

1、The data tested by surface mounted on a 1 inch2 FR-4 board with 2OZ copper.

2、The EAS data shows Max. rating . VDD =50V, VG =10V, ,L=10mH, IAS =5A, Starting TJ=25 ºC

3、The test condition is Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 1%

4、The power dissipation is limited by 150℃ junction temperature

5、The data is theoretically the same as ID and IDM , in real applications , should be limited by total power dissipation.

## Typical Characteristics

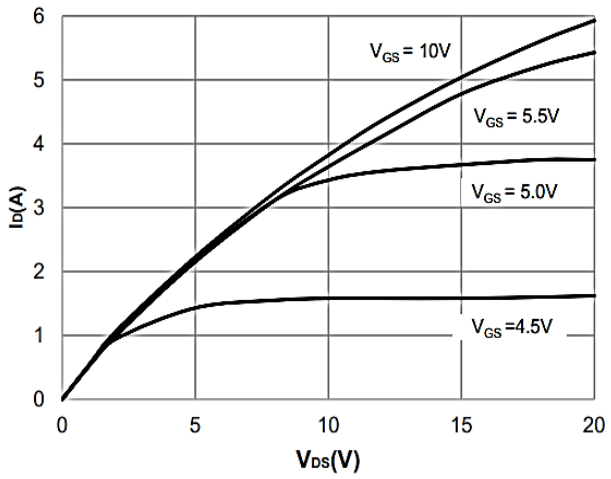



Figure1: Output Characteristics

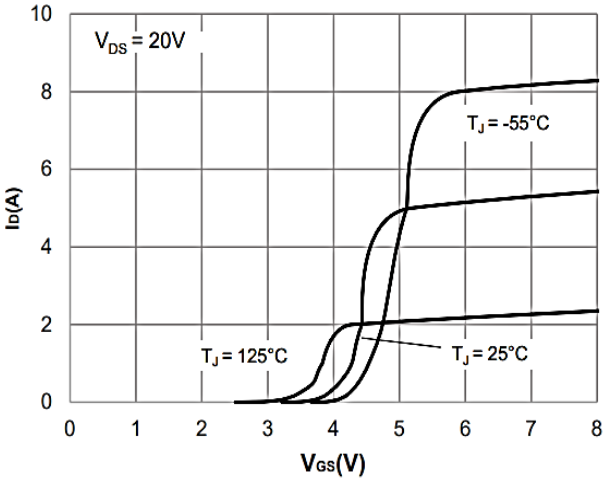



Figure 2: Typical Transfer Characteristics

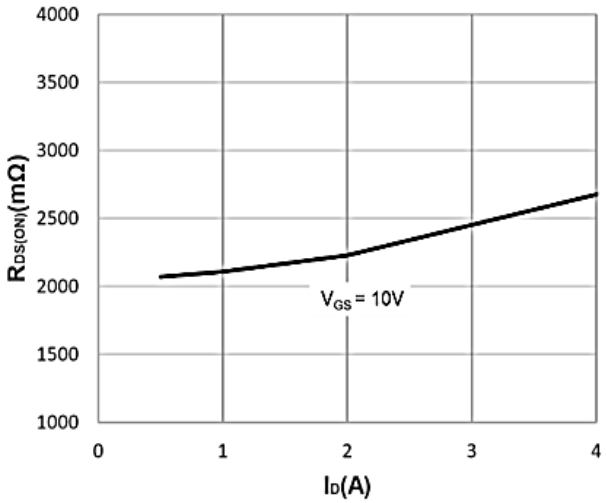



Figure 3:On-resistance vs. Drain Current

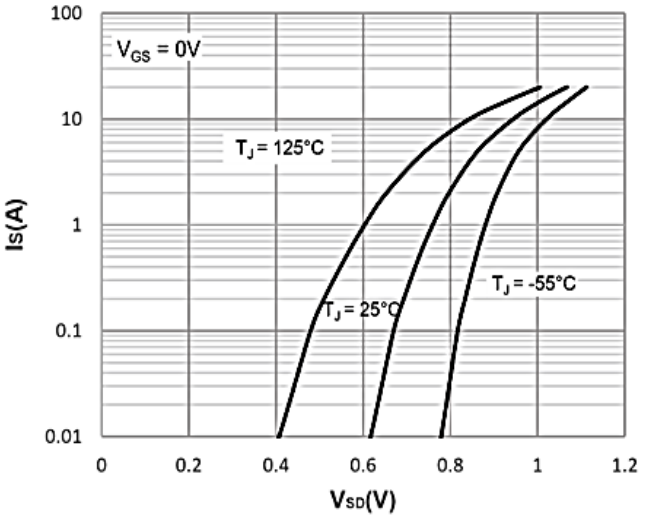



Figure 4: Body Diode Characteristics

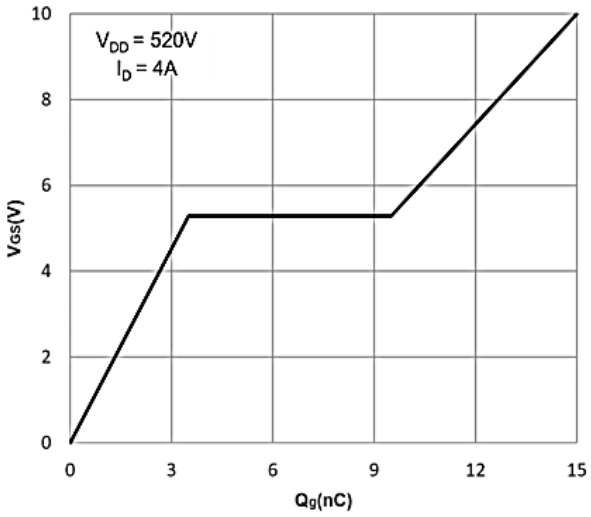



Figure 5: Gate Charge Characteristics

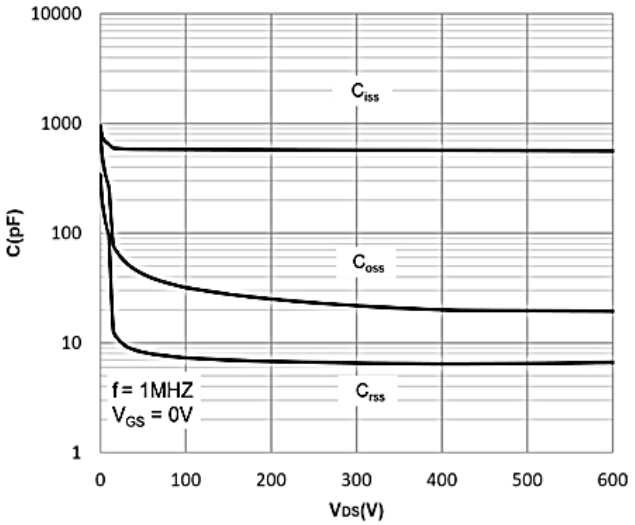



Figure 6: Capacitance Characteristics

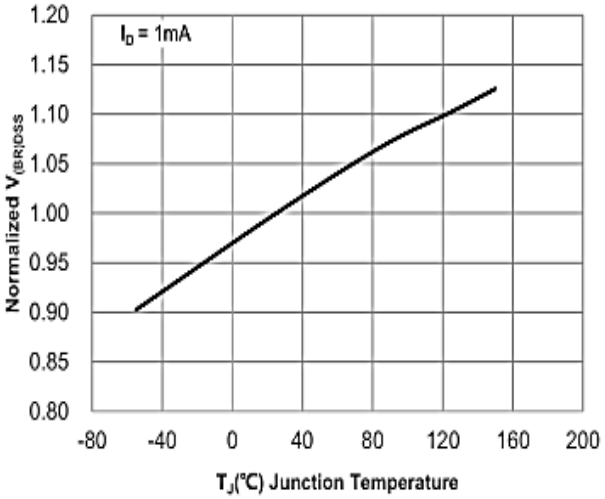



Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

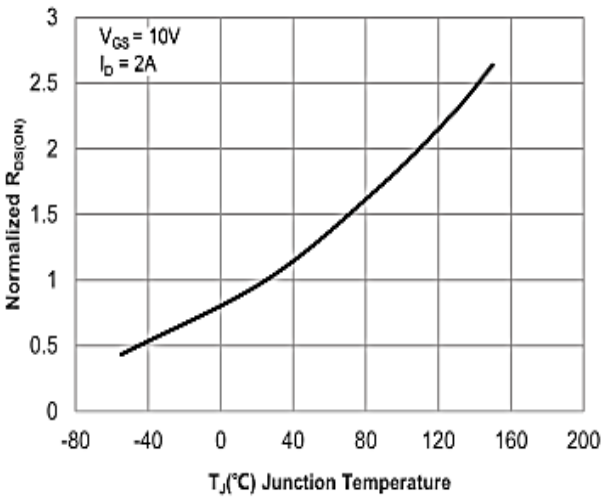



Figure 8: Normalized on Resistance vs. Junction Temperature

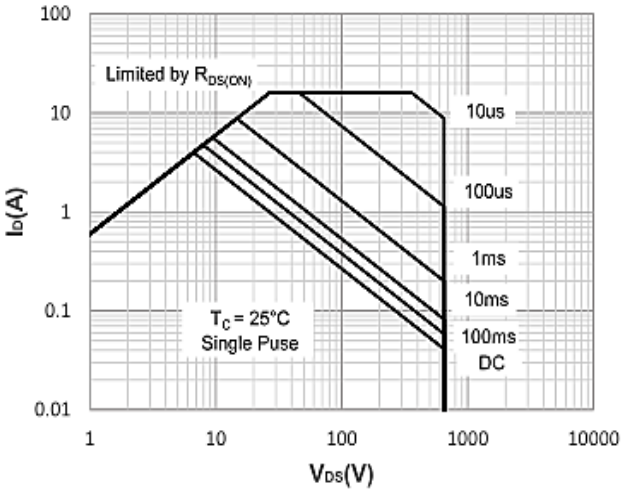



Figure 9: Maximum Safe Operating Area

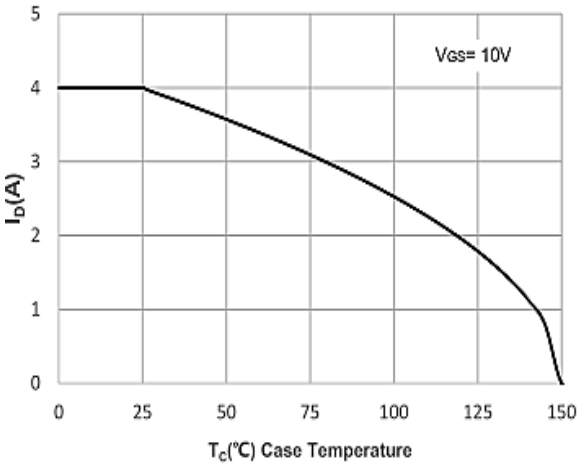



Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

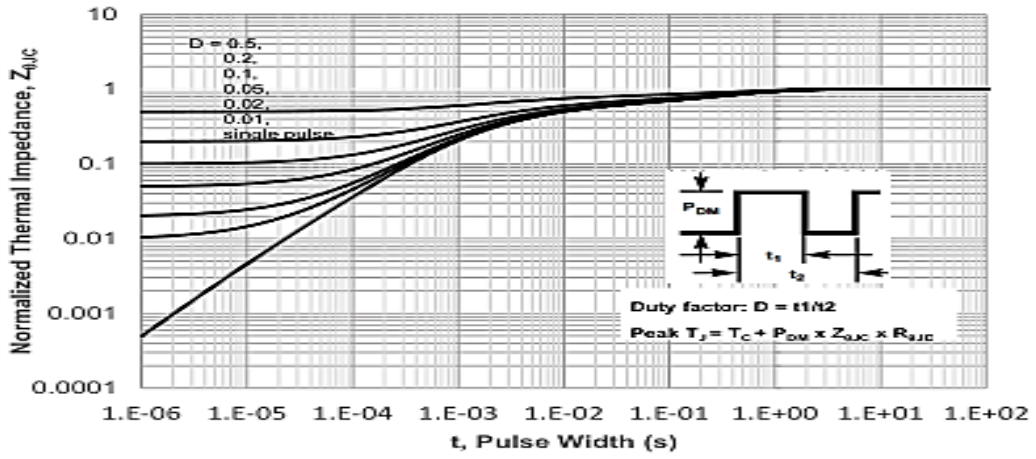
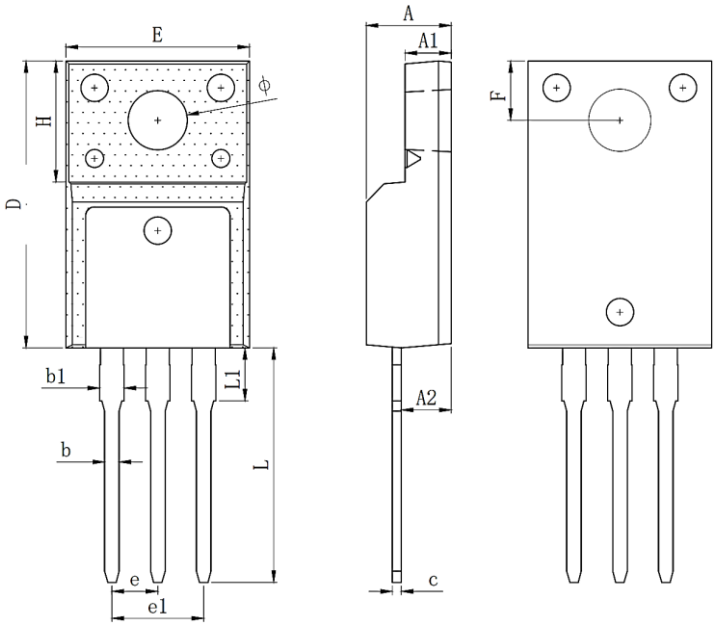


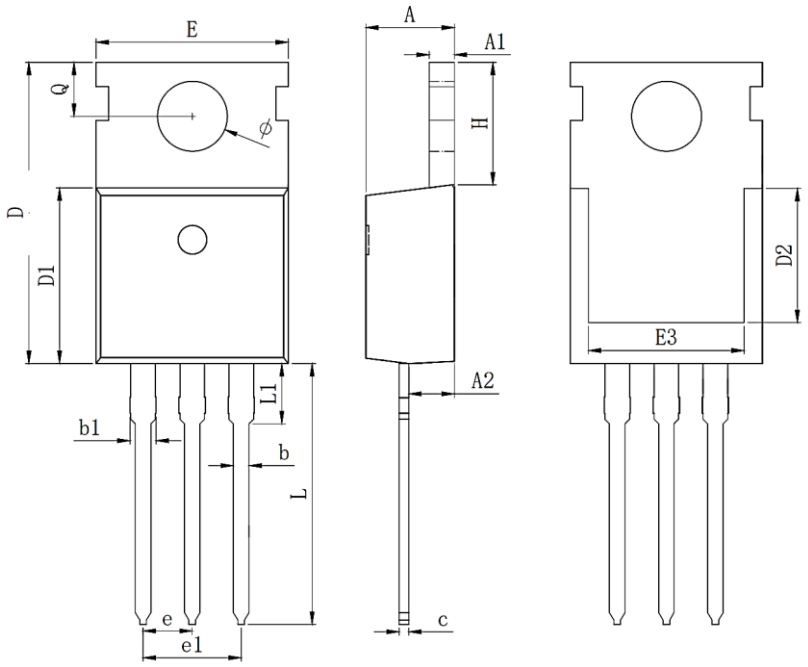

Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

## Package Mechanical Data:TO-220F-3L



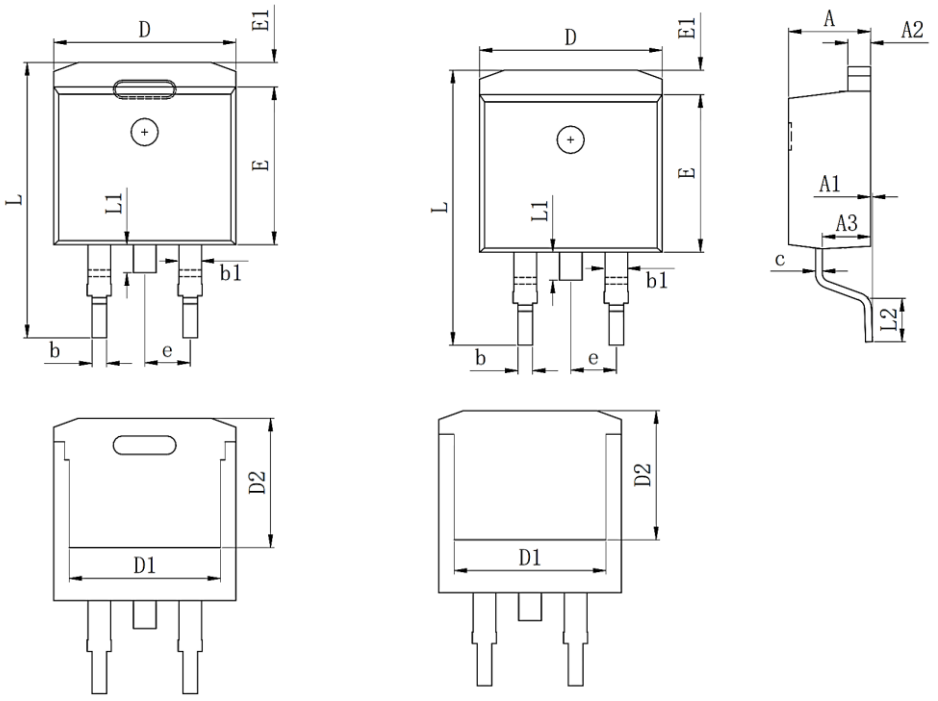

| Symbol | Dim in mm | | |
|---|---|---|---|
| | Min | Typ | Max |
| A | 4.5 | 4.7 | 5.0 |
| A1 | 2.34 | 2.54 | 2.84 |
| A2 | 2.4 | 2.9 | 3.4 |
| b | 0.7 | 0.8 | 0.95 |
| b1 | 1.05 | 1.35 | 1.55 |
| c | 0.4 | 0.5 | 0.65 |
| D | 15.57 | 15.87 | 16.17 |
| H | 6.7REF | | |
| E | 9.86 | 10.16 | 10.46 |
| e | 2.54BSC | | |
| e1 | 5.08BSC | | |
| L | 12.65 | 12.98 | 13.3 |
| L1 | 2.78 | 3.08 | 3.38 |
| F | 3.15 | 3.3 | 3.55 |
| ϕ | 3 | 3.3 | 3.65 |

## Package Mechanical Data:TO-220C-3L




| Symbol | Dim in mm | | |
|---|---|---|---|
| | Min | Typ | Max |
| A | 4.25 | 4.5 | 4.7 |
| A1 | 1.15 | 1.3 | 1.45 |
| A2 | 2.15 | 2.35 | 2.55 |
| b | 0.65 | 0.8 | 0.95 |
| b1 | 1.15 | 1.35 | 1.55 |
| c | 0.35 | 0.5 | 0.65 |
| D | 14.3 | 15.3 | 16.3 |
| D1 | 8.8 | 9.1 | 9.4 |
| D2 | | 6.3REF | |
| E | 9.7 | 10 | 10.3 |
| E3 | 7 | 8 | 9 |
| e | | 2.54BSC | |
| e1 | | 5.08BSC | |
| L | 12.7 | 13.5 | 13.9 |
| L1 | | 3.1 | 3.4 |
| H | 6 | 6.5 | 6.95 |
| Q | 2.6 | 2.8 | 3 |
| ϕ | 3.4 | 3.6 | 3.8 |

## Package Mechanical Data:TO-263C-3L




| Symbol | Dim in mm | | |
|---|---|---|---|
| | Min | Typ | Max |
| A | 4.37 | 4.57 | 4.77 |
| A1 | 0 | | 0.25 |
| A2 | 1.22 | 1.27 | 1.42 |
| A3 | 2.49 | 2.69 | 2.89 |
| b | 0.7 | 0.81 | 0.96 |
| b1 | 1.17 | 1.27 | 1.47 |
| c | 0.3 | 0.38 | 0.53 |
| D | 9.86 | 10.16 | 10.36 |
| D1 | 8.4REF | | |
| D2 | 7.073REF | | |
| E | 8.5 | 8.7 | 8.9 |
| E1 | 1.07 | 1.27 | 1.47 |
| e | 2.54BSC | | |
| L | 17.7 | 15.1 | 15.5 |
| L1 | 1.4 | 1.55 | 1.7 |
| L2 | 2 | 2.3 | 2.6 |
| H | 6 | 6.5 | 6.95 |
| Q | 2.6 | 2.8 | 3 |
| ϕ | 3.4 | 3.6 | 3.8 |

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